Ethnic Inequalities in Dental Caries among Adults in East London

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ABSTRACT

Background: This study explored ethnic inequalities in dental caries among adults and assessed the role of socioeconomic position (SEP) in explaining those inequalities.

Methods: We analysed data on 2,013 adults aged 16 to 65 years, from the East London Oral Health Inequality (ELOHI) Study, which included a random sample of adults and children living in East London in 2009-2010. Participants completed a questionnaire and were clinically examined for dental caries at home. Dental caries was measured using the number of decayed, missing and filled teeth or DMFT index. Ethnic inequalities in dental caries were assessed in negative binomial regression models before and after adjustment for demographic (sex and age groups) and SEP measures (education and socioeconomic classification).

Results: White Eastern European and White Other had higher DMFT whereas all Asian (Pakistani, Indian, Bangladeshi and Other) and all Black (African, Caribbean and Other) ethnic groups had lower DMFT than White British. Similar inequalities were found for the number of filled and missing teeth, but there were no differences in the number of decayed teeth between ethnic groups.

Conclusion: This study showed considerable disparities in dental caries between and within the major ethnic categories, which were independent of demographics and SEP.

Key words: ethnicity, oral health, socioeconomic factors, inequalities, adults.

INTRODUCTION

There are major inequalities in oral health within and between countries.[1-3] Oral health inequalities are found not only by measures of social standing (such as education, occupation and income) but also by cultural factors such as ethnicity, environmental factors such as geographic location, and other characteristics historically linked to discrimination or exclusion.[4] Oral health inequalities by race and ethnicity have been shown in several countries, and the majority of studies in Europe and the Americas showed that White adults tend to exhibit better dental and periodontal health than the other ethnic groups.[5-9]

Only a few studies have explored oral health inequalities by ethnicity among British adults and they all share a number of limitations.[10-13] First, all previous studies were based on small convenience samples from specific ethnic groups (i.e. only South Asians, only Caribbean, etc.) which precludes any generalisation of findings to wider populations. Second, they did not include a sample of White residents from the same geographic region for comparison purposes, but instead compared their findings against figures obtained from concurrent national surveys. Such a comparison is not useful because it does not account for area of residence which is a key determinant of health. Despite these limitations, it has been suggested that being from an ethnic minority group in the UK does not necessarily correspond to having poorer oral health.[14] Adults from ethnic minorities usually had more teeth and lower levels of caries experience than national population averages.[10-13]

Furthermore, it is not clear from the above studies whether these differences are due to race/ethnicity *per se* or confounding variables that are related to both ethnicity and oral health related behaviours and status. Previous studies in other countries have shown that socioeconomic position (SEP) may fully explain ethnic disparities in oral health because ethnic groups are disproportionately overrepresented in the lower SEP groups,[15-17] while others have reported the persistence of ethnic inequalities after adjustment for SEP measures.[18-20] Importantly, the composition of ethnic groups varies by country which precludes any comparison and it is possible that significant factors influencing the oral health status of minority ethnic groups in one country may not be relevant to the other.

Therefore, the aim of this study was to determine whether there were ethnic disparities in dental caries among adults living in a deprived area of the UK and exposed to the same environmental

factors. A second aim was to explore whether SEP measures could explain ethnic differences in dental caries.

SUBJECTS AND METHODS

This article analysed data from the East London Oral Health Inequality (ELOHI) Study which included adults 16 to 65 years old living in Waltham Forest, Redbridge and Barking and Dagenham in 2009-2010. This mixed methods study has been carried out in a socially and material deprived area of London since 2009 aiming to further understand oral health disparities, in particular the barriers, facilitators and pathways between neighbourhood deprivation, oral health behaviours and oral health status. It included quantitative and qualitative phases. The Outer North East London (ONEL) Research Ethics Committee approved the study protocol (08/H0701/93). Participants who agreed to voluntarily participate provided written informed consent.

Phase 1 of the ELOHI study adopted a cross-sectional study design. A multi-stage stratified random sampling approach was used to select a representative sample of the ethnically-diverse general non-institutionalised population in ONEL. The sampling frame was a list of all addresses stratified by the number of wards in Barking and Dagenham (n=17), Redbridge (n=21) and Waltham Forest (n=20). Fifty-five addresses were randomly selected from each ward to yield 3,193 addresses. Residents were then contacted by post, and invited to participate in the study. Non-respondents were visited to ascertain the household was empty and age of residents. We excluded 457 commercial premises or vacant addresses and 208 ineligible households with no residing adults age 16 to 65 years. The final sampling frame included 2,528 valid addresses and 1,437 households agreed to participate in the study. The household response rate in Barking and Dagenham, Redbridge and Waltham Forest was 61%, 52.2% and 61.2% respectively, which represented a total response rate of 57%. Non-respondents were replaced by inviting residents in the same postcode area. As a result the mean Index of Multiple Deprivation (IMD) scores in the sample and for the population in 2007 were 33.46 and 34.45 respectively. The IMD is a census area-level measure made up of seven domain indices of deprivation (income, employment, health and disability, education skills and training, barriers to housing services, crime and living environment). A maximum of two adults per household were invited to participate, and all agreed yielding a sample of 2,343 adults who reported their age, gender and ethnicity and participated in at least one part of the survey.

Participants underwent an oral examination and answered a supervised questionnaire in their own homes. Trained and calibrated dentists performed the oral examinations using the UK Adult Dental Health Survey protocol[21] and standardised equipment (e.g. Daray light lamps, mirror and periodontal probes). All teeth, including third molars, were clinically examined. Participants' teeth were not brushed or professionally cleaned prior to examination, but debris and moisture were removed from individual sites with cotton wool rolls or cotton buds if visibility was obscured and probes were used for cleaning debris from the tooth surfaces to enable visual examination. Dental caries was visually diagnosed at the caries into dentine threshold (including visual dentine caries) without radiography or fibre-optic trans-illumination, following the criteria used in the UK Adult Dental Health Survey.[21] Duplicate examinations were carried out among participants to assess intra examiner agreement within a two-week interval. Examiners' assessments were individually compared with the reference examiner assessment under field circumstances. The Kappa value (n=133 subjects) for dental status at tooth level was 0.83, with values higher than 0.80 considered acceptable.[22]

Following the clinical examination participants answered a supervised self-complete questionnaire. The questionnaire included questions on socio-demographic factors (age, gender, ethnicity, nativity status, time since migration, SEP and education) and oral health status. Ethnicity was self-assigned using an adaptation of the 2001 UK Census categories, which included 26 possible categories under five main ethnic groups: White, Asian, Black, Mixed or Other. Individuals' SEP was measured by education and the National Statistics Socio-Economic Classification (NS-SEC). Education was indicated by the highest degree or qualification (no qualifications, secondary school, A levels, technical qualifications, first university degree or higher degree). NS-SEC groups were derived using the self-coded method based on current or last main job or occupation, employment status, size of organisation and supervisory status. Five operational categories were derived: (1) managerial and professional, (2) intermediate, (3) small employers and own account workers, (4) lower supervisory and technical, and (5) semi-routine and routine occupations. For complete coverage of the population, full-time students, individuals who had never worked or were in long-term unemployment and those not classified for other reasons were added as not classified.[23]

Statistical analysis

We weighted the data to adjust for the unequal probability of selection and non-response and to produce a representative sample (with respect to age, gender and ethnicity) based on the UK Census

in 2001. Weighting the data did not increase the size of the sample (weighted data=2,266 adults). All analyses took into account the data weighting and the complex survey design (stratification and clustering) to produce corrected standard errors and confidence intervals. This data analysis further excluded 253 participants due to missing data on dental caries (n=2), education (n=172) and socioeconomic classification (n=89). Therefore, data analysis for this sub-study included 2,013 adults. Post-hoc calculation demonstrated that the minimum sample size to provide 80% statistical power to identify an odds ratio of 1.5 and/or a risk ratio of 1.2 was estimated to be 822.[24] The calculation assumed 50% of the unexposed population and 60% of the exposed population to have the outcome of interest, α equal to 0.05, and β equal to 0.20.

Data manipulation was minimal. The 26 ethnic categories were regrouped to generate 12 groups: White British, East European and Other; Black African, Caribbean and Other; Asian Pakistani, Indian, Bangladeshi and Other; Mixed and Other. The White Other group included West European, Mediterranean, North and Latin America, combined because of the small numbers. Black Other included Black British, European and American, while the Asian Other included Asian British, Middle Eastern/Arabic, Chinese, and Japanese. Age was categorised into ten year brackets (mid-decade to mid-decade) to cover against possible non-linear effects. Education was re-categorised into four groups (no qualification, secondary school, A levels and higher education) and socioeconomic classification was further categorised into managerial and professional (1), intermediate (2/3), routine and manual occupations (4/5) and not classified due to small numbers in adjacent categories.

Four caries measures were assessed in this study, namely, the numbers of decayed (DT), missing (MT) and filled teeth (FT) and the DMFT index. Ethnic inequalities in dental caries were assessed in negative binomial regression as the four caries measures were count variables with over-dispersion. Rate ratios (RR) were therefore reported. Ethnic differences in each caries measure were first presented in unadjusted models (labelled as Model 1) and then in models adjusted for demographic factors (Model 2) and also for SEP measures (Model 3). Finally, the moderating role of education and socioeconomic classification on the relationship between ethnicity and each caries measure was examined by assessing the significance of the statistical interaction (cross-product) between each SEP measure and ethnicity in a model also including the main effects.[25] Two-way Interaction terms were added to the main effect model, one at a time, in order to test their significance.

RESULTS

The demographic and socioeconomic characteristics of the sample are shown in Table 1. Whites, Asians and Blacks represented 68%, 20% and 9% of the sample, respectively. Only 19% were living in the UK for less than 10 years. There were no significant socio-demographic differences between the full ELOHI study sample (n=2,266) and the analytical sub-sample for this study (n=2,103).

Ethnic disparities in dental caries are shown in Table 2. Every Asian (Pakistani, Indian, Bangladeshi and Other) and Black (African, Caribbean and Other) ethnic group had significantly lower DMFT values than each of the three White groups (British, East European and Other). By DMFT components, Asian and Black ethnic groups had fewer filled and missing teeth than White groups. However, there were no differences in the number of decayed teeth between ethnic groups.

Ethnic disparities in caries experience were attenuated but persisted after adjustment for demographic factors and SEP measures (Table 3). Two distinctive patterns of ethnic disparities were identified. While Non-British White groups had a significantly higher DMFT than White British (22% and 27% higher for White East European and White Other, respectively), it was significantly lower for all Black (African 52%, Caribbean 34% and Other 32% lower than White British) and Asian groups (Pakistani 49%, Indian 41%, Bangladeshi 47% and Other 30% lower than White British). The same patterns of ethnic disparities were found for the numbers of missing and filled teeth in subsequent analysis by DMFT components (Table 4). Compared to White British, White Other had more and Black African, Black Other and all Asian groups had fewer missing teeth. Similarly, White East European and Other had more and all Black and Asian groups had fewer filled teeth than White British. No differences in number of decayed teeth were found between ethnic groups. Finally, the two-way interaction terms of education with ethnicity and socioeconomic classification with ethnicity were not significant in regression models for each caries measure (all $p>0.05$).

DISCUSSION

Main findings of this study

Ethnic disparities in dental caries among adults living in a deprived area of the UK were found for lifetime caries experience but not for present untreated caries. On average, Asians and Blacks had better dental status than Whites. The magnitude of these differences was such that Asians and Blacks had, respectively, 42% (RR: 0.58; 95% CI: 0.53-0.64) and 45% (RR: 0.55; 95% CI: 0.49-0.61) lower DMFT than Whites. The association between ethnicity and caries experience was independent

and not confounded by time lived in the UK or socio-economic measures. These findings are relevant because to our knowledge this was the first study exploring ethnic inequalities in dental caries in a large population-based sample including three major ethnic groups living in the same area, thus exposed to the same environmental factors.

What is already known on this topic

UK studies on ethnic disparities in adult oral health share a number of methodological limitations.[10-13] Therefore, it is not surprising that conflicting findings have been reported. Although studies in other developed countries showed that White adults have better oral health than the other ethnic groups,[5-9] it has also been reported that being from an ethnic minority group in the UK does not necessarily correspond to having poorer oral health.[14] Furthermore, some researchers have argued that collapsing ethnic categories into broader ethnic groups ignores the heterogeneity that exists within broadly defined ethnic group.[26-28] A study carried out in pre-school children in East London reported greater caries experience among White East European compared to White British.[28] Disparities between these White sub-groups would have been masked if all White ethnic categories were collapsed into a single class for analysis. In addition, although Pakistani and Bangladeshi had higher DMFT than White British, the same was not true for other Asian ethnic groups (Indian and Asian Other).[28]

What this study adds

This study demonstrates clearly that ethnic disparities between and within major ethnic groups exist. Ethnic disparities in dental caries experience, as measured by the DMFT index, are likely to be due to cultural differences rather than race (genetic make-up). Our results show significant differences in lifetime caries experience between White sub-groups exposed to the same environmental risks. White East Europeans and White Other had respectively 22% and 27% higher DMFT than White British. Such a difference within the same race strongly suggests that differences in caries experience may be explained by other factors. Moreover, the findings provide stronger evidence than previous studies to claim that Asians and Blacks had significantly lower DMFT values than Whites.

Ethnic disparities in lifetime caries experience reflected those found in numbers of missing and filled teeth. This finding suggests that White British may have experienced higher levels of decay in their lifetime or overtreatment. White British and East European had more filled than missing teeth (FT/MT

ratio of 1.41 and 1.65, respectively), which compared favourably with FT/MT ratios for Asian and Black ethnic groups (all below 1.27). What is more, Asian Pakistani and Bangladeshi had more missing than filled teeth (FT/MT ratios of 0.89 and 0.80, respectively). Data from the US, where access to dental care is mostly privately funded, showed that African Americans were less likely to receive dental cleaning, restorative dentistry and prosthodontic services and more likely to have teeth extracted than Whites.[29, 30] There is further evidence suggesting that dentists discuss limited options of treatment with ethnic minority groups.[31, 32]

This study also provides further evidence that SEP explains partially but not fully ethnic disparities. Some researchers have argued that ethnic disparities in oral health could be fully explained by the socioeconomic composition of ethnic groups.[15-17] In a review of UK literature on oral health inequalities, Watt and Sheiham[14] argued that there were no differences in oral health among minority ethnic groups of the same socioeconomic status and that the inclusion of ethnicity as a variable for dental caries may no longer be relevant as it could divert attention from more important variables such as income and social class. Education and socioeconomic position explained less than 5% of the association between ethnicity and caries experience (percent attenuation in RRs). This minor attenuation in RRs after adjustment for SEP measures may also be related to the relative high levels of material and social deprivation of East London leading to small variation in SEP measures in the sample. No evidence for a moderating effect of socioeconomic position on ethnic inequalities in caries experience was found either. The fact that in this study SEP measures explained only a small part of the ethnic differences in dental caries implies that other factors may also underlie that relationship. Further studies should explore the relative roles of cultural factors, which may help to identify modifiable factors that are more amenable to intervention so as to reduce oral health inequalities.

Limitations of the study

Some limitations of this study need to be discussed. First, this study analysed cross-sectional data which limits the ability to establish causal relationships between variables. Second, the fact that our study sample represented 89% of the adults who participated in the ELOHI study may raise some concerns about its representativeness and the effect of missing data on the results. However, we found no differences in socio-demographic composition between our study sample and the full sample of ELOHI participants, which supports that missing data are unlikely to have impacted the results and that they can be generalized to the study population. Third, the twelve ethnic groups

compared in this study were derived by collapsing 26 ethnic categories. Some ethnic categories included very few survey participants, producing small cell sizes and unreliable estimates. Therefore, they were collapsed into “other ethnic groups”. We assessed the main ethnic groups living in East London and the UK (White British, Indian, Pakistani, Black Caribbean, Black African) according to the 2001 UK Census and an emerging ethnic minority (White East European). Fourth, we examined the moderating role of education and socioeconomic classification in multiplicative interactions despite additive interactions having more public health relevance because they allow assessing whether it would be preferable to target an intervention toward certain subgroups if resources are limited.[33, 34] Tests for additive interactions are not yet available in standard software and have not been fully explored in relation to count regression models.

To conclude, this study showed considerable ethnic disparities in oral health among adults in East London (UK). Compared to White British, White East European and White Other exhibited higher caries experience whereas all Asian (Indian, Pakistani, Bangladeshi and Asian Other) and Black (African, Caribbean and Black Other) groups exhibited lower caries experience. These differences reflected those found in numbers of missing and filled teeth. Ethnic disparities were independent of socioeconomic factors. Further studies should explore the contribution of cultural factors to explain ethnic disparities in oral health.

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Table 1. Demographic and socio-economic characteristics of 16-65-year-old adults from East London, by ethnic group (n=2,013)

Characteristics	n[a]	(%)
Sex		
Men	638	(48.5)
Women	1375	(51.5)
Age groups		
16-24 years	163	(16.7)
25-34 years	743	(25.2)
35-44 years	743	(24.6)
45-54 years	214	(19.4)
55-65 years	150	(14.2)
Ethnicity		
White British	565	(53.9)
White East European	72	(5.9)
White Others	88	(8.2)
Black African	282	(4.7)
Black Caribbean	88	(1.8)
Black Other	135	(2.6)
Pakistani	202	(5.6)
Indian	118	(3.4)
Bangladeshi	75	(1.8)
Asian Other	325	(8.9)
Mixed	28	(1.7)
Other	35	(1.7)
Education		
No qualification	190	(13.3)
Secondary school	477	(26.7)
A levels	516	(25.5)
Higher education	830	(34.5)
Socio-economic classification		
Managerial/professional	840	(42.0)
Intermediate	312	(17.0)
Routine/manual	406	(23.4)
Not classified	455	(17.6)
Nativity/time lived in the UK		
Born in the UK	796	(57.7)
Migrated >10 years ago	595	(19.4)
Migrated 10+ years ago	622	(22.9)

[a] Counts are unweighted

Table 2. Caries experience measures by demographic and socioeconomic characteristics among 16-65-year-old adults from East London (n=2,013)

Characteristics	DT	MT	FT	DMFT
	Mean [95% CI]	**Mean [95% CI]**	**Mean [95% CI]**	**Mean [95% CI]**
Ethnic groups				
White British	1.20 [0.67-1.73]	5.10 [4.62-5.59]	7.17 [6.44-7.90]	13.47 [12.52-14.42]
White East European	2.06 [1.13-2.98]	3.81 [3.08-4.55]	6.31 [4.92-7.71]	12.18 [10.44-13.93]
White Other	0.89 [0.52-1.26]	6.52 [4.95-8.09]	8.01 [6.64-9.38]	15.42 [13.54-17.29]
Black African	1.44 [1.06-1.81]	1.72 [1.44-2.00]	1.80 [1.41-2.18]	4.95 [4.34-5.56]
Black Caribbean	0.59 [0.25-0.94]	3.54 [2.34-4.73]	4.12 [2.70-5.55]	8.25 [6.21-10.30]
Black Other	1.01 [0.65-1.36]	3.31 [2.26-4.36]	4.23 [3.36-5.11]	8.55 [6.86-10.23]
Asian Pakistani	0.91 [0.66-1.16]	2.43 [1.86-2.99]	2.18 [1.61-2.75]	5.52 [4.50-6.54]
Asian Indian	1.21 [0.76-1.66]	2.80 [2.15-3.45]	3.40 [2.55-4.26]	7.41 [6.09-8.74]
Asian Bangladeshi	1.39 [0.83-1.95]	2.43 [1.77-3.10]	1.95 [1.16-2.74]	5.77 [4.70-6.84]
Asian Other	1.11 [0.72-1.49]	3.31 [2.95-3.67]	3.68 [3.07-4.28]	8.09 [7.26-8.92]
Mixed	1.16 [0.36-1.96]	3.53 [2.23-4.83]	4.35 [2.60-6.10]	9.04 [6.50-11.58]
Other	0.80 [0.12-1.48]	3.06 [1.81-4.31]	3.73 [1.76-5.70]	7.60 [5.28-9.91]
P value[a]	*0.071*	*<0.001*	*<0.001*	*<0.001*
Sex				
Men	0.91 [0.55-1.26]	4.23 [3.82-4.65]	6.48 [5.74-7.23]	11.62 [10.71-12.53]
Women	1.08 [0.79-1.37]	4.01 [3.31-4.72]	7.02 [5.89-8.15]	12.12 [10.84-13.39]
P value[a]	*0.104*	*0.131*	*0.055*	*0.053*
Age groups				
16-24 years	1.94 [0.93-2.94]	1.94 [0.93-2.94]	1.91 [1.33-2.50]	6.90 [5.65-8.16]
25-34 years	1.44 [0.94-1.94]	1.44 [0.94-1.94]	3.89 [3.39-4.39]	8.27 [7.50-9.04]
35-44 years	0.78 [0.65-0.90]	0.78 [0.65-0.90]	5.81 [5.36-6.26]	10.16 [9.66-10.66]
45-54 years	0.75 [0.45-1.06]	0.75 [0.45-1.06]	9.67 [8.68-10.67]	15.99 [14.92-17.06]
55-65 years	1.20 [0.77-1.62]	1.20 [0.77-1.62]	9.13 [7.89-10.36]	18.86 [17.69-20.04]
P value for trend[a]	*0.037*	*<0.001*	*<0.001*	*<0.001*
Education				
No qualification	1.87 [1.33-2.42]	5.49 [4.24-6.75]	5.78 [4.21-7.34]	13.14 [10.78-15.50]
Secondary school	1.36 [0.97-1.75]	4.98 [4.33-5.63]	6.21 [5.39-7.03]	12.55 [11.53-13.58]
A levels	1.27 [0.49-2.05]	4.54 [3.89-5.19]	5.60 [4.91-6.29]	11.41 [10.30-12.53]
Higher education	0.74 [0.58-0.89]	3.47 [3.19-3.74]	5.91 [5.24-6.58]	10.11 [9.35-10.88]
P value for trend[a]	*<0.001*	*<0.001*	*0.854*	*<0.001*
Socio-economic classification				
Managerial/professional	0.67 [0.44-0.89]	4.20 [3.81-4.58]	6.94 [6.26-7.61]	11.80 [11.01-12.60]
Intermediate	1.16 [0.85-1.47]	4.81 [3.96-5.65]	7.00 [6.07-7.93]	12.96 [11.61-14.31]
Routine/manual	1.95 [1.11-2.80]	4.86 [4.05-5.68]	4.84 [3.98-5.70]	11.65 [10.23-13.08]
P value for trend[a]	*<0.001*	*0.131*	*0.001*	*0.995*

[a] Negative binomial regression was used for comparison. P values correspond to omnibus tests for any difference between groups or for tests for linear trends.

Table 3. Models for ethnic differences in caries experience among 16-65-year-old adults from East London (n=2,013)

Ethnic groups	Model 1[a]	Model 2[a]	Model 3[a]
	RR[b] [95% CI]	RR[b] [95% CI]	RR[b] [95% CI]
White British	1.00 [reference]	1.00 [reference]	1.00 [reference]
White East European	0.90 [0.77-1.06]	1.20 [1.01-1.41]*	1.22 [1.03-1.43]*
White Others	1.14 [0.99-1.32]	1.25 [1.10-1.41]**	1.27 [1.12-1.43]***
Black African	0.37 [0.32-0.42]***	0.48 [0.40-0.56]***	0.48 [0.41-0.56]***
Black Caribbean	0.61 [0.47-0.79]***	0.66 [0.54-0.80]***	0.66 [0.55-0.80]***
Black Other	0.63 [0.51-0.78]***	0.67 [0.56-0.79]***	0.67 [0.57-0.80]***
Asian Pakistani	0.41 [0.34-0.50]***	0.51 [0.42-0.61]***	0.51 [0.43-0.62]***
Asian Indian	0.55 [0.45-0.67]***	0.57 [0.47-0.70]***	0.58 [0.48-0.71]***
Asian Bangladeshi	0.43 [0.35-0.52]***	0.52 [0.43-0.64]***	0.52 [0.42-0.64]***
Asian Other	0.60 [0.53-0.68]***	0.70 [0.61-0.79]***	0.70 [0.62-0.79]***
Mixed	0.67 [0.50-0.90]**	0.81 [0.63-1.06]	0.81 [0.63-1.04]
Other	0.56 [0.41-0.77]***	0.71 [0.52-0.97]*	0.72 [0.53-0.98]*

[a] Model 1 was unadjusted; Model 2 adjusted for demographic factors (sex, age groups and nativity/ time lived in the UK); Model 3 additionally adjusted for socioeconomic position (education and socioeconomic classification).
[b] Negative binomial regression models were fitted and rate ratios (RR) reported.

Table 4. Models for ethnic differences in number of decayed (DT), missing (MT) and filled teeth (FT) among 16-65-year-old adults from East London (n=2,013)

Outcome	Ethnic groups	Model 1[a]	Model 2[a]	Model 3[a]
		RR[b] (95% CI)	RR[b] (95% CI)	RR[b] (95% CI)
DT	White British	1.00 [reference]	1.00 [reference]	1.00 [reference]
	White East European	1.72 [0.91-3.23]	1.22 [0.62-2.40]	1.47 [0.79-2.74]
	White Others	0.74 [0.40-1.37]	0.65 [0.38-1.12]	0.75 [0.44-1.28]
	Black African	1.20 [0.72-2.00]	1.06 [0.66-1.70]	1.34 [0.86-2.09]
	Black Caribbean	0.50 [0.24-1.03]	0.41 [0.21-0.80]*	0.48 [0.22-1.03]
	Black Other	0.84 [0.48-1.48]	0.79 [0.50-1.26]	0.97 [0.62-1.54]
	Asian Pakistani	0.76 [0.45-1.28]	0.59 [0.35-0.99]	0.77 [0.48-1.23]
	Asian Indian	1.01 [0.57-1.80]	0.91 [0.55-1.49]	1.20 [0.74-1.95]
	Asian Bangladeshi	1.16 [0.64-2.11]	1.26 [0.70-2.27]	1.63 [0.88-3.05]
	Asian Other	0.92 [0.53-1.62]	0.88 [0.54-1.43]	0.92 [0.57-1.47]
	Mixed	0.97 [0.43-2.19]	0.68 [0.32-1.43]	0.82 [0.39-1.73]
	Other	0.67 [0.26-1.75]	0.47 [0.21-1.03]	0.49 [0.23-1.05]
MT	White British	1.00 [reference]	1.00 [reference]	1.00 [reference]
	White East European	0.75 [0.60-0.93]**	1.03 [0.83-1.27]	1.05 [0.85-1.30]
	White Others	1.28 [0.99-1.66]	1.40 [1.14-1.71]***	1.42 [1.16-1.73]**
	Black African	0.34 [0.28-0.41]***	0.45 [0.36-0.55]***	0.44 [0.36-0.55]***
	Black Caribbean	0.69 [0.49-0.98]*	0.79 [0.57-1.09]	0.79 [0.58-1.09]
	Black Other	0.65 [0.47-0.90]**	0.67 [0.53-0.86]**	0.69 [0.54-0.87]**
	Asian Pakistani	0.48 [0.37-0.61]***	0.60 [0.47-0.76]***	0.60 [0.47-0.77]***
	Asian Indian	0.55 [0.43-0.70]***	0.58 [0.45-0.76]***	0.60 [0.47-0.78]***
	Asian Bangladeshi	0.48 [0.36-0.64]***	0.60 [0.46-0.77]***	0.59 [0.45-0.75]***
	Asian Other	0.65 [0.56-0.75]***	0.79 [0.68-0.91]**	0.78 [0.68-0.91]**
	Mixed	0.69 [0.47-1.01]	0.87 [0.60-1.26]	0.86 [0.61-1.23]
	Other	0.60 [0.39-0.91]*	0.78 [0.53-1.14]	0.78 [0.54-1.13]
FT	White British	1.00 [reference]	1.00 [reference]	1.00 [reference]
	White East European	0.88 [0.69-1.12]	1.29 [0.99-1.69]	1.30 [0.99-1.71]
	White Others	1.12 [0.92-1.36]	1.28 [1.00-1.63]*	1.28 [1.01-1.61]*
	Black African	0.25 [0.20-0.32]***	0.37 [0.27-0.51]***	0.36 [0.27-0.49]***
	Black Caribbean	0.57 [0.40-0.82]**	0.58 [0.44-0.77]***	0.57 [0.44-0.75]***
	Black Other	0.59 [0.47-0.74]***	0.63 [0.50-0.79]***	0.63 [0.51-0.79]***
	Asian Pakistani	0.30 [0.23-0.40]***	0.41 [0.31-0.55]***	0.41 [0.31-0.54]***
	Asian Indian	0.47 [0.36-0.62]***	0.50 [0.37-0.67]***	0.48 [0.36-0.65]***
	Asian Bangladeshi	0.27 [0.18-0.41]***	0.36 [0.22-0.57]***	0.34 [0.22-0.54]***
	Asian Other	0.51 [0.42-0.62]***	0.63 [0.50-0.79]***	0.63 [0.51-0.77]***
	Mixed	0.61 [0.40-0.92]*	0.78 [0.53-1.14]	0.78 [0.54-1.12]
	Other	0.52 [0.30-0.89]*	0.65 [0.41-1.01]	0.65 [0.42-0.99]*

[a] Model 1 was unadjusted; Model 2 adjusted for demographic factors (sex, age groups and nativity/ time lived in the UK); Model 3 additionally adjusted for socioeconomic position (education and socioeconomic classification).
[b] Negative binomial regression models were fitted and rate ratios (RR) reported.